Ampersand 3 (2016) 52–60

Contents lists available at ScienceDirect

Ampersand

journal homepage: www.elsevier.com/locate/amper

The influence of morphological knowledge on lexical processing and acquisition: The case of Arab EFL learners

Ahmed M. Masrai

Department of English Language and Literature, Swansea University, Swansea, Wales SA2 8PP, UK

HIGHLIGHTS

- Morphological knowledge links to L2 vocabulary acquisition.
- Regular inflectional morphology explains approximately 38% of the variance in L2 Vocabulary uptake.
- Derivational morphology does not explain L2 vocabulary development.
- L1 Arabic morphological rules do not contribute to L2 morphological awareness.

ARTICLE INFO

Article history:
Received 11 November 2015
Received in revised form
23 February 2016
Accepted 11 April 2016
Available online 14 April 2016

Keywords:
Morphological processing
Vocabulary acquisition
Arabic
Inflection
Derivation

ABSTRACT

Although morphological knowledge has been proposed to enhance second language (L2) vocabulary acquisition, little is known about which morphological process has the greatest impact on lexical acquisition. To address this question, 400 school-learners of English from high schools in Saudi Arabia were presented with a morphological decomposition task of regular and irregular inflection and derivation, and an L2 vocabulary size test. The results indicated some significant levels of correlation between knowledge of regular inflection and derivation, and L2 vocabulary knowledge. Irregular inflection and derivation, on the contrary, were not found to have a significant effect on L2 vocabulary acquisition. Although significant correlations were observed between regular morphology and L2 vocabulary learning, regression analysis showed that only regular inflection processing has a sizable effect on vocabulary uptake. This variable explained about 38% of the variance *per se*. The findings also revealed no clear effect of the first language (L1) regularity of morphological rules, which apply extensively in Arabic, on acquiring words that are regular in English. The overall findings propose an explicit focus on teaching regular inflectional morphology in the language classroom because of its marked influence found on vocabulary acquisition.

1. Introduction

Understanding how words are formed is potentially a key component in developing a sizeable second language (L2) lexicon. Additionally, as vocabulary knowledge increases L2 learners should gain insights into morphological processing of the target language. Morphological knowledge has been studied extensively on the literature of L2 acquisition (e.g. Refs. [14,15,19,20,36,44]), and mastery of morphological structure has long been proposed to be linked to vocabulary acquisition [8,41]. However, there is relatively scant research that has attempted to explore the link between L2 learners' ability to manipulate the morphological elements of words and the development of their vocabulary size with native Arabic speakers. This study, therefore, is an endeavour to explore this assumption among native Arabic learners of English as a foreign language (EFL) in Saudi Arabia, where no study, to the author's knowledge, has been conducted.

Studies of vocabulary acquisition in Saudi Arabia repeatedly show a small EFL vocabulary gain by schoolchildren (e.g. Refs. [2,3,5,32]). Potential factors underlying this poor vocabulary uptake are not adequately investigated. There are two studies found in the literature that have endeavoured to explore this

E-mail address: a.m.masrai@swansea.ac.uk.

http://dx.doi.org/10.1016/j.amper.2016.04.001

matter. Alsaif and Milton [6] propose that insufficient vocabulary input from learners' textbooks might, to an extent, explain the little vocabulary learning by Saudi school learners. More recently [33,34], point out that L2 words with direct L1 Arabic translation equivalents are better learnt than words which do not have this feature. This is an area where more systematic research is needed. Since morphological processing is largely associated with vocabulary learning, the presumption that less morphological awareness/knowledge by native Arabic EFL learners might explain, at least in part, the hurdle of L2 vocabulary acquisition.

The study will examine this assumption through lexical decomposition task of regularly and irregularly inflected and derived English words and its relationship to the learners' receptive vocabulary knowledge. A number of psycholinguistics studies, however, have proposed that both derivational affixes and regular inflectional affixes comprise morphological decomposition for lexical access [4]. This notion, however, is not the case with irregular inflections, which have been suggested to be stored as full entries in the mental lexicon [31,45,50,51]. Additionally, a body of research also suggests that a word root is activated when regularly inflected or derived forms are processed, but this feature is not available when irregular inflected forms are processed [18,29,48]. Thus, tapping into morphological processing through lexical decomposition task is believed to be appropriate for the purpose of the current study. The following section will briefly review the morphological processing of regular and irregular words and discuss how words are stored and retrieved from the mental lexicon.

2. Morphological processing

One of the most debated issues in second language acquisition (SLA) research has been on whether certain linguistic processes can be captured within a single associative networks (e.g. [9,39,47]), or a dual-route mechanism (e.g., [45,51]). Advocates of single-network models argue that regularly inflected or derived words are stored in the mental lexicon by either having superimposed representations [12] or by having a full word representations cluster around a nucleus represented by the stem [30]. The dual-route mechanism line of research, on the other hand, shows that regular and irregular inflections have multiple dissociations which support a distinction between rule-based and associative processing of regular and irregular inflections.

In support of dual-route processing, which challenges the single network models [45] offered evidence that regular and irregular inflections show multiple dissociations which support a distinctive aspect between associative and rule-based processes for regularly and irregularly inflected forms. According to the dual-route model, a rule-based process is a common procedure that concatenates an affix (i.e., -ed) with a variable standing for syntactic category of the stem. This rule hence applies freely to a given word of the correct category, irrespective of phonological form [45]. Irregular inflections, on the contrary, include the representation of stem and inflected forms in an associative memory network.

Research on inflectional morphology, at least in part, shows a distinction between regular and irregular morphological processing. This distinction, however, is less clear in derivational morphology. It appears that there is no sense in which derivational processes have a common form of application and a more idiosyncratic form. Nonetheless, there are some differences in the degree of productivity between diverse derivational processes [4]. For instance, the agentive −er suffix attaches with most verbs stems, where −ist is much more selective. In the context of L2 vocabulary acquisition, inflectional morphology processing is seen as less problematic than derivational morphology processing, and that L2 learners can develop morphological awareness knowledge of inflectional process faster than derivational process [33,34].

In addition to the potential effect of L2 morphological knowledge on developing a sizeable L2 lexicon, transferring the existing L1 morphological awareness might enhance the process of L2 vocabulary acquisition. In Arabic language, knowledge of morphological rules is mastered at early stages of language acquisition [1,21]. Thus, this attribute of Arabic language might, to a certain degree, be transferred and utilised when approaching L2 vocabulary learning. A brief discussion of how words are formed in Arabic is presented in the following section.

3. An overview of the Arabic mental lexicon

There are at least two views which are claimed to account for how complex forms are represented in the Arabic mental lexicon and processed on-line. The first is a morpheme-based approach, which suggests that Arabic surface forms comprise a root and a word pattern [16,38]. The second is a stem-based approach, which dispenses with roots and word patterns and views the Arabic lexicon as being structured around processes that take the stem as a basic unit [10,23,46]. In this section, both views will be discussed, and evidence of the approach that is believed to model the Arabic mental lexicon will be offered.

3.1. The root and pattern approach

The root and pattern approach includes at the minimum three distinct versions which differ either in terms of the number of morphemic units they put forward or in terms of the way surface word forms are believed to be created. According to the earliest version of the approach/model, the morphological system hinges on two morphemes: a consonantal root which carries a broad semantic meaning, and a vocalic word pattern which carries non-referential aspects of meaning such as perfective, or active [11]. These two units are interwoven to create a deverbal noun stem called مصدر [maṣdar]. However, the derivation of all the other surface forms does not involve root and pattern combination, but proceeds on the bases of the deverbal noun stem employing different morpho-phonological procedures such as pre-fixation, infixation, and vowel deletion or insertion ([11]; p. 32).

In contrast, the second version of the root and pattern view considers every surface form as a combination of a root and a word pattern, and the lexicon as a repository of roots and patterns with a set of rules to associate them [17,25]. The third representation of the root and pattern approach is established within the framework of auto-segmental phonology [37,38]. In this view, Arabic morphology is thought to function with three morphemes: a consonantal root, which remains believed to deliver the core semantic meaning, a vocalic melody conveying morpho-syntactic meaning such as active-passive, and a CV-Skeleton that provides morpho-syntactic information as well as determining the phonological structure of the surface form [11]. Similar to the second version of the root and pattern approach, McCarthy's model necessitates that the root, the vocalic melody and the CV-Skeleton are merged to derive every surface form.

Despite the variation between the three versions of the root and pattern approach, there is an agreed upon unity underlying their apparent diversity. Precisely, they all ascribe a morphemic status to the root and the pattern.

3.2. The stem-based approach

Similar to the root and pattern approach, the stem-based approach is not a homogenous approach, but incorporates a number of different versions. For example [24], had attempted to draw a distinction between lexical representations, morphological derivation, and lexical processing and contends that as far as lexical representation and morphological derivation are concerned, the consonantal root is best "consigned to oblivion" ([24]; p. 115). There is no principled way, according to [24]; to separate consonants and vowels and ascribe them to distinctive levels of representation. This is because the word patterns, or ablaut templates as he refers to them, cannot be said to contribute any grammatical information in many cases. For instance, stems such as خُبِز [XuBZ] 'bread', كلب [KaLB] 'dog' and سِلْم [SiLM] 'peace' abound in the language, yet their corresponding word patterns CuCC, CaCC and CiCC do not carry any grammatical information. However, where lexical processing is concerned, Heath confesses that "root-like strings are extracted from input representations […] but these extracted consonantal sequences do not correspond exactly to the traditionally recognised roots, particularly where vowels and semi-vowels are concerned" ([24]; pp. 126–128).

The two views presented above have implications for the way Arabic words are accessed and stored in the mental lexicon, though envisaged in different approaches. However, very recently [11], evaluated both morpheme-based and stem-based approaches and suggested an obligatory morphological decomposition (OMD) model. The model was compared to a connectionist account and a dual-route account. The findings from the study suggest that OMD model is robust and shows that the Arabic, and indeed the Semitic lexicon, are organised in terms of morphemes which govern spoken and written word recognition processes. Generally [11], concluded that morphemic effects have widely applicable implications for how Arabic words are recognised from script and speech. Not only do they strongly suggest that lexical access representations are organised in terms of roots and patterns, but also "indicate that modality-free central representations of lexical form and meaning are structured in terms of the same units" ([11]; p.51). Moreover, the same units appear to control both the early decomposition processes and the principal processes of access to meaning from spoken and written discourse with the stem itself playing no role in the lexical access process *per se*.

This overview of the Arabic word formation processes provides insights into the way rules, which are very regular in Arabic, implemented to create a large number of new words from a given root. However, unlike Arabic, word formation in English is not that regular. Therefore, lexical items that are irregular in English might possibly be problematic for native Arabic EFL learners. To reiterate, the studies that concern themselves with the measurement of L2 vocabulary knowledge of native Arabic learners, all suggest a very low vocabulary uptake, about one word per contact hour in a language classroom. Those studies indicate a marked issue in L2 vocabulary acquisition by Arabic learners, but provide no clear explanation to this pertinent matter. This study is an attempt to explain, at least in part, one of the hurdles language learners are faced with and propose relevant pedagogical implications.

4. The study

The main aim of the current study is to explore the impact of morphological processing knowledge/awareness of L2 regular and irregular words on L2 lexical access and development. To achieve the study objectives, the following research questions were addressed:

- Do native Arabic EFL learners produce regular base words from the most commonly inflected and derived words significantly better than words which are irregular?
- Do native Arabic EFL learners process L2 inflectional morphology significantly different from derivational morphology?
- Is there a relationship between morphological processing awareness and L2 vocabulary size?
- Does the regularity of rules in Arabic language, which applies extensively, has any marked effect on processing regularly and irregularly inflected and derived English words?

The expectation is that learners will perform better in producing base forms which are regular. This is because inflections and derivations of irregular words, as suggested by many studies, are stored separately from the base forms in the mental lexicon. On the other hand, inflections and derivations of regular words might activate the base forms when encountered (e.g. Refs. [4,18,29,48]). Furthermore, it is excepted to see some levels of correlation between learners morphological knowledge and their L2 breadth of vocabulary knowledge.

5. Method

5.1. Participants

The participants undertook the tests in this study were 400 school learners from three different regions in Saudi Arabia. They were all attending the three high school levels when data were collected. Their ages varied from 16 years-old in the first level to 18 in the final level ($M = 17$, $SD = 1.21$), and the only known source of English they had was classroom instruction. The participants in this study had attended, on average, 576 EFL classroom hours in level one, 704 in level two, and 832 in level three. The participants were low-level native Arabic learners of EFL.

5.2. Material

Two instruments were used in the study to collect the required data. One is a morphological decomposition test, comprising of 50 items (see Appendix A). These items were selected from a lemmatised word frequency list, which was originally developed by Ref. [27] from the British National Corpus (BNC). Thereafter, the items were examined to assure their occurrences in the learners' textbooks. Words included in this test were divided equally into two categories. One category involved a number of 25 regularly inflected and derived words. The other category included exactly the same number of irregularly inflected and derived words. The lists of regular and irregular forms, however, were carefully selected based on certain criteria: (a) each pair of regular and irregular forms was very similar in terms of frequency, so frequency was not biased; (b) each pair of words was also tested for repetition across learners' textbooks; (c) common inflectional and derivational endings were also observed for each pair. Correlation analysis was conducted to ensure that bias between the two groups of words was, as far as possible, eliminated. Table 1 shows the correlation statistics for word frequency and repetition across learners' textbooks for both the regular and irregular lists of words.

The second instrument used in the study was the X-Lex

Table 1
Correlations between regular and irregular words in terms of frequency (BNC_list) and repetition (textbooks).

	Word frequency ir	Word repetition re	Word repetition ir
Word frequency re	0.969[a]	0.365[a]	0.419[a]
Word frequency ir	–	0.327[b]	0.433[a]
Word repetition re	–	–	0.906[a]

Note. Each category contains 50 words; re = regular; ir = irregular.
[a] Correlation is significant at the 0.01 level (2-tailed).
[b] Correlation is significant at the 0.05 level (2-tailed).

vocabulary size test [40] (see Appendix B). X-Lex is a yes/no test which measures receptive knowledge of the most frequently occurring 5000 words in English and estimates the overall knowledge of this vocabulary. Words included in the test are selected from lists drawn from Refs. [26,42]; and are lemmatised. The test is available in both computer-based and paper and pencil formats. The second format was used in the current study. The test presents learners with 120 words, divided into six columns. Learners have to indicate whether they know each word. There are 20 randomly selected words from each 1000 word-frequency band, and a further 20 pseudo-words that are designed to look like words in English but are not real English words. The number of yes responses to these pseudo-words allows the score on the real words to be adjusted for guessing and overestimation of knowledge. There is no time limit to sit the test, which generally takes 5–10 min to complete. Scoring system of the test is provided in Section 5.4.2 of the paper.

5.3. Procedure

The two test used in the study were administered to the participants by the researcher with assistance provided by volunteer teachers from the schools where the data were collected. The tests were sat in two successive intervals separated by a short break of about 20 min. Before the tests were administered, participants were provided with clear oral and written instruction about the purpose of the tests. Information about the participants, such as age and any extra exposure to the English language outside the classroom was also recorded. The tasks were straightforward. In the decomposition test, the participants were only needed to produce the English base words from the regularly and irregularly inflected and derived forms provided in the test. The vocabulary size test is a yes/no in nature, which incorporates non-words to adjust for potential of guesswork, where the informants needed only to tick the word they know. There was no time limit to perform the tests, but they were designed to not exceed 25 min in the decomposition task and 10 min in the X-Lex. The tests were conducted during the usual daily school classes.

5.4. Tests scoring systems

5.4.1. Morphological decomposition test

After the data were collected, all the responses were marked manually. As the participants were asked to write the correct base words from the given forms, the spelling was considered while marking. Toleration of very simple mistakes in the spelling was taken into account when recording adjusted scores. Each correctly produced base word was given one mark (the maximum possible score is 25 in each category). After marking was completed and final scores were registered, the data were then entered into SPSS software package (version 22) for analysis.

Table 2
Summary of learners' scores in the morphological decomposition test and X-lex test.

Responses	Mean	N	Std. deviation	Std. error mean
Regular words	8.59	400	5.74	0.29
Irregular words	2.52	400	2.35	0.12
X-lex	890.05	400	682.32	28.03

5.4.2. Vocabulary size test (X-Lex)

A learner's vocabulary knowledge in the X-Lex test is calculated by counting the number of yes responses to real words and multiplying the result by 50 to give a raw score out of 5000. The number of yes responses to pseudo-words is then calculated and multiplied by 250. This figure is deducted from the raw score to give an adjusted score, which thus includes a compensation for guesswork. The adjusted scores are those reported in this study. They are estimations of the learners' passive receptive vocabulary size. The instructions for test administration and marking, as suggested by the test's authors, were followed.

6. Results and discussion

6.1. Regular and irregular inflection and derivation scores

To provide answer to the first research question concerning learners' ability of producing base forms from regularly and irregularly inflected and derived words, the results after the data were analysed are presented in Tables 2 and 3. The tables show paired sample statistics to identify mean, standard deviation and standard deviation error of mean, and the statistical difference between the means (*t*-test).

It can be clearly seen from the results displayed in Table 2 that the mean score is in favour of regular words responses. The difference is apparently higher when compared to the irregular mean score. The difference between means, however, is statistically significant ($t = 28.095$, $p < 0.001$), as indicated in Table 3. This suggests that decomposition of regular base words from regularly inflected and derived forms is accessible. In contrast, difficulty in breaking-down irregularly inflected and derived forms into their constituents is apparently clear from the results reported in Table 2.

These findings appeared to support those from previous research (e.g. Refs. [4,18,29,48]), which suggest that regular base words are activated, but not irregular ones, when inflections and derivations are processed. Nevertheless, the overall knowledge of regular base words is found to be very low. Various reasons might help to explain this low knowledge. One is that learners at this

Table 3
Paired-samples *t*-test scores of regular and irregular inflection and derivation.

Paired differences								
	M	SD	SD M.E[a]	95% CI		*T*	df	*P*
				Lower	Upper			
Regular & irregular responses	5.98	4.25	0.21	5.56	6.40	28.095	399	0.000

Note.
[a] Standard deviation of mean error.

particular level might potentially feel under pressure when producing words productively, which would probably underestimate their knowledge. A second probable reason is that EFL learners in this study are likely to be less-sensitive to morphological parsing during processing of base words. In fact, this is not surprising, as many studies have found that L2 learners are generally less aware of morphological structure than native speakers, and depend mostly on lexical storage than morphological processing of L2 words (e.g. Refs. [13,52]). Finally, it could be argued here that a threshold of vocabulary knowledge should be achieved before L2 learners can utilise the morphological processing in both L2 words recognition and use. However, this kind of threshold is not yet exactly known, but [43] 2000 words threshold can be taken into consideration to direct research in this area.

6.2. Inflectional and derivational morphology

In spite of the fact that the results summarised in the previous section provide useful information about the knowledge of native Arabic EFL leaners of processing regular and irregular words, further exploration of the data might explain more factors of the emerging difficulty. In this section, therefore, an attempt was made to find out answer to the second research question - whether learners experience difficulty in processing words which are regularly and irregularly inflected or those which are derived. Tables 4 and 5 summarise the results.

The results reported in Tables 4 and 5 reveal that native Arabic EFL learners perform significantly better in producing base words from inflected forms than those which are derived, regardless of whether they are regular or irregular. The difference in the learners' mean score is significant ($p < 0.001$) in both regular and irregular forms. The findings from this study appear to suggest that there is a marked difference between processing inflected and derived English words, at least as far as the learners whose L1 is Arabic are concerned.

Nevertheless, the question of whether learning L2 inflection and derivation differ in any extensive way is controversial among researchers. Some morphologists (e.g. Refs. [22,28]) do not distinguish explicitly between the process of inflection and derivation. Others, on the other hand, (e.g. Refs. [7,35,49]) suggest a difference between morphological processing of inflections and derivations. For example [7] proposes that “derivational word formation rule constitutes a mapping between phonological, syntactic, and semantic properties of one set of lexical items and the corresponding properties of another set.” This suggests that some derivational affixes are not necessarily attached to the main verb but probably to the other shortened forms. In the case of low proficient learners, as it is the case of the participants in this study, it might be very confusing for them to decide whether derivational affixes are linked to the main verb or to the shortened form. Therefore, this could explain the very few responses to the derived forms rather than inflected ones. Generally, findings from these studies seem to agree that derivational processes rely on the lexical storage of derivational affixes in the mental lexicon, whereas inflectional processes are rule-based mechanisms.

6.3. Morphological processing and vocabulary size

This part of the study examined the relationship between morphological processing and vocabulary acquisition to provide answer to the third research question. Two types of analyses were performed for the data to find any potential relationship. First, Pearson correlation coefficient was performed for participants' responses to regularly and irregularly inflected and derived words and their vocabulary size. Second, regression analysis was also conducted to find the predictor variable that best explains the vocabulary development.

Table 6 shows the correlations between vocabulary size and the learners' decomposition ability of words with regular and irregular inflections and derivations. The results show some significant levels of correlations between the vocabulary size and the morphological processing of regular inflection and derivation ($r = 0.613$; 0.399, respectively) but not with the processing of irregular inflection and derivation. These results accord with the claims that the base word is activated when processing regularly inflected and derived forms but not the irregularly inflected and derived forms (e.g. Refs. [4,18,29,48]). Nonetheless, regression analysis was further performed to see if morphological processing of regular inflection and derivation can predict vocabulary acquisition.

The regression model, shown in Table 7, suggests that morphological knowledge of regular inflection contributes to the learners' uptake of vocabulary. Processing of regular inflection explained nearly 38% of the variance *per se*. However, derivation variable was excluded from the model as a consequence of its

Table 4
Summary of learners' performance in regular and irregular inflection and derivation.

		Mean	N	Std. deviation	Std. error mean
Pair 1	Regular inflection	6.4650	400	4.20213	0.21011
	Regular derivation	1.9275	400	1.88178	0.09409
Pair 2	Irregular inflection	1.8250	400	1.69604	0.08480
	Irregular derivation	0.6950	400	0.65807	0.03290

Table 5
Paired-samples *t*-test scores of learners' performance in regular and irregular inflection and derivation.

Paired differences								
	M	SD	SD M.E[a]	95% CI		*T*	df	*P*
				Lower	Upper			
Pair 1 regular inf. regular der.	4.54	3.30	0.16	4.21	4.86	27.448	399	0.000
Pair 2 irregular inf. irregular der.	1.13	1.54	0.07	0.97	1.28	14.668	399	0.000

Note.
[a] Standard Deviation of Mean Error; inf = inflection; der = derivation.

Table 6
Pearson correlations between vocabulary size and regularly and irregularly inflected and derived forms.

	Regular inf.	Regular der.	Irregular inf.	Irregular der.
X-Lex score	0.613[a]	0.399[b]	0.242	0.229

Note. inf. = inflection; dev. = derivation.
[a] Correlation is significant at the 0.01 level (2-tailed).
[b] Correlation is significant at the 0.01 level (2-tailed).

Table 7
Model summary of regression analysis.

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.613[a]	0.376	0.375	332.47630

[a] Predictors: (Constant), regular inflection.

insignificant effect on predicting vocabulary development. Some studies (e.g. [8,41]), propose that mastery of morphological structure is linked to vocabulary acquisition, but do not disclose which aspect of morphological processing is strongly associated with L2 vocabulary learning. The current study took a further step to provide evidence of a considerable effect of inflection processing on L2 vocabulary acquisition.

The final research question addressed in this study was whether L1 (Arabic) morphological awareness has any influence on L2 vocabulary acquisition. The intuitive appeal was that Arab EFL learners could transfer their skills of applying rules to derive new words in their L1 to learning regular English words more effectively than irregular ones. However, there seems to be little evidence to validate this assumption. Despite that the findings show that native Arabic learners' performance in responding to regular forms is significantly better than the irregular forms, the mean score (8.59) is a bout the third of the maximum possible score (25), which very low. This raise the question of whether this morphological knowledge is a causal effect of L1 transfer, or may be that regular morphological processing is a less complex process than irregular morphology.

By and large, the finding from this study, however, revealed not only that native Arabic EFL learners experience difficulty knowing the irregular base words when they are provided with their inflected and derived forms but also experience a more challenging task when words are derived. The findings seem to generally suggest that, because L1 Arabic speakers favour rule-based derivation, they are more able to acquire rule-based forms where they exist in English. Learners perhaps transfer this approach from Arabic to English. This language skill transfer has emerged even with a comparatively low level of vocabulary knowledge. However, a clear conclusion in relation to this particular point could not be drawn for certain reasons. First, the lack of evidence of whether native English speakers do the same as Arabic speakers in terms of developing regularly derived forms before the irregular ones. Second, will learners of EFL from L1 background other than L1 Arabic perform in the same way. Investigating this matter is, thus, recommended for further research. Another point, which the study did not explore and might be interesting for further investigation, is looking at the morphological awareness at each level. Learners at different proficiency levels are assumed to adopt different strategies, and findings from such a study might suggest interesting teaching implication.

7. Conclusion

The results of the study reported in this paper suggest that native Arabic learners experience more difficulty in producing base words from irregularly inflected and derived forms. This is probably not a consequence of utilising the high regularity of L1 rules, but most likely that regular English words are rule-governed. It seems that L1 Arabic speakers treat the English differently to L1 English speakers and try to create a base form with more rules, rather than more base forms and fewer rules. Additionally, findings reveal that Arabic EFL learners have difficulty processing regular and irregular derivational morphology in a similar way. The current study, however, does not rule out the reasons for this emerging issue, therefore, it is proposed that further research might be very useful in handling this matter. A more focused research could be on how inflectional and derivational morphology are activated in the regions of a human brain among Arabic EFL learners. Finally, one important finding in this study is that only regular inflectional morphology plays a significant role in L2 vocabulary acquisition. Therefore, a focused classroom teaching approach which includes both rules for regular inflectional, and derivational, morphology processing might usefully be taken into consideration by language teachers. This would enhance L2 vocabulary uptake, and thus motivates learners to undertake the task of derivational morphology.

Appendix A

Morphological decomposition test

Name (Code): ……..…… Level: ……...

Please write the base form (present tense) for each of the following words. You can use this example:

Reader ⟶ Read

فضلاً اكتب اصل كل كلمة من الكلمات التالية (الفعل المضارع البسيط). تستطيع استخدام هذا المثال:

قارئ ⟵ يقرأ

	Word الكلمة	اصل الكلمة (الفعل المضارع البسيط)
1	looked	
2	given	
3	useable	
4	finder	
5	told	
6	calling	
7	meaningful	
8	provided	
9	left	
10	seemingly	
11	feeling	
12	needed	
13	kept	
14	starts	
15	players	
16	brought	
17	movable	
18	written	
19	settings	
20	met	
21	producer	
22	stood	
23	developed	
24	spoke	
25	receiver	
26	bought	
27	describing	
28	winnable	

29	agreement	
30	understandable	
31	reached	
32	built	
33	explainer	
34	sold	
35	establishes	
36	broken	
37	achieved	
38	growth	
39	manager	
40	chooses	
41	proved	
42	drove	
43	removal	
44	worn	
45	revealed	
46	fought	
47	asking	
48	thrown	
49	examination	
50	taught	

Appendix B

X-Lex Vocabulary Size Test

Please look at these words. Some of these words are real English words and some are invented but are made to look like real words. Please tick the words that you know or can use. Here is an example. **book ✓**

Thank you for your help.

من فضلك انظر الى هذه الكلمات. بعض هذه الكلمات هي كلمات انجليزية حقيقية والبعض الأخر كلمات تم تركيبها لتبدو وكأنها كلمات حقيقية. فضلاً اختر الكلمات التي تعرفها أو تستطيع استخدامها. استخدم هذا المثال.

كتاب ✓

شكراً لمساعدتكم،،

that	both	cliff	sandy	lessen	darrock
with	century	stream	military	oak	waygood
before	cup	normal	impress	antique	kennard
person	discuss	everywhere	staircase	chart	gazard
feel	park	deny	daily	limp	fishlock
round	path	shot	essential	permission	cantileen
early	tower	refer	associate	headlong	gillen
table	weather	independent	conduct	violent	pardoe
question	wheel	feeling	relative	fade	frequid
effect	whole	bullet	upward	rake	hobrow
market	perform	juice	publish	trunk	candlin
woman	pity	nod	insult	mercy	litholect
stand	probable	gentle	cardboard	anxious	gumm
believe	signal	slip	humble	pedestrian	alden
fine	dish	diamond	contract	arrow	treadaway
instead	earn	press	mount	feeble	sumption
produce	sweat	provide	tube	sorrow	horozone
group	trick	drum	moreover	brighten	hyslop
arrive	manage	reasonable	crisis	dam	manomize
difficult	mud	boil	jug	outlet	horobin

References

[1] S. Abu-Rabia, Reading in a root–based–morphology language: the case of Arabic, J. Res. Read. 25 (3) (2002) 299–309.
[2] A. Al-Bogami, Teaching English Vocabulary to EFL Male Students at Intermediate and Secondary Public Schools in Riyadh, Unpublished MA dissertation, King Saud University, 1995.
[3] H. Al-Hazemi, Low Level EFL Vocabulary Tests for Arabic Sp, Unpublished PhD Thesis, University of Wales Swansea, 1993.
[4] M. Alegre, P. Gordon, Rule-based versus associative processes in derivational morphology, Brain Lang. 68 (1999) 347–354.
[5] A. Alsaif, Investigating Vocabulary Input and Explaining Vocabulary Uptake Among EFL Learners in Saudi Arabia, Unpublished PhD thesis, Swansea University, 2011.
[6] A. Alsaif, J. Milton, Vocabulary input from school textbooks as a potential contributor to the small vocabulary uptake gained by English as a foreign language learners in Saudi Arabia, Lang. Learn. J. 40 (1) (2012) 21–33.
[7] S.R. Anderson, A-morphous Morphology, Cambridge University Press, Cambridge, 1992.
[8] J. Anglin, Vocabulary Development: a Morphological Analysis: Monographs of the Society for Research in Child Development. (Serial No. 238), University of Chicago Press, Chicago, 1993.
[9] D.M. Basnight-Brown, L. Chen, S. Hua, A. Kostić, L.B. Feldman, Monolingual and bilingual recognition of regular and irregular English verbs: sensitivity to form similarity varies with first language experience, J. Mem. Lang. 57 (1) (2007) 65–80.
[10] E. Benmamoun, The role of the imperfective template in Arabic morphology, in: J. Shimron (Ed.), Language Processing and Acquisition in Languages of Semitic, Root-based, Morphology, John Benjamins, Amsterdam, 2003, pp. 99–114.
[11] S. Boudelaa, Is the Arabic mental lexicon morpheme-based or stem-based? Implications for spoken and written word recognition, in: E. Saiegh-Haddad, R.M. Joshi (Eds.), Handbook of Arabic Literacy, vol. 9, Springer, Netherlands, 2014, pp. 31–54.
[12] J.L. Bybee, Diachronic and typological properties of morphology and their implications for representation, in: L.B. Feldman (Ed.), Morphological Aspects of Language Processing, Erlbaum, Hillsdale, NJ, 1995, pp. 225–246.
[13] H. Clahsen, C. Felser, Grammatical processing in language learners, Appl. Psycholinguist. 27 (1) (2006) 3–42.
[14] E.V. Clark, R.A. Berman, Types of linguistic knowledge: interpreting and producing compound nouns, J. Child Lang. 14 (1987) 547–567.
[15] E.V. Clark, B.F. Hecht, Learning to coin agent and instrument nouns, Cognition 12 (1982) 1–24.
[16] D. Cohen, Le vocabulaire de base sémitique et le classement des dialectes du sud, Semitica 11 (1961) 55–84.
[17] M. Cohen, Langues chamito- sémitiques et linguistique historique, Scientia 86 (1951) 304–310.
[18] P. Cole, C. Beauvillain, J. Segui, On the representation and processing of prefixed and suffixed derived words: a differential frequency effect, J. Mem. Lang. 28 (1989) 1–13.
[19] G.M. Gottfried, Comprehending compounds: evidence for metaphoric skill? J. Child Lang. 24 (1997) 163–186.
[20] G.M. Gottfried, Using metaphors as modifiers: children's production of metaphoric compounds, J. Child Lang. 24 (1997) 567–601.
[21] N.Y. Habash, Introduction to Arabic natural language processing, Synthesis Lect. Hum. Lang. Technol. 3 (1) (2010) 1–187.
[22] H. Harley, R. Noyer, State-of-the-article: distributed morphology, GLOT 4 (1999) 3–9.
[23] J. Heath, Moroccan Arabic phonology, in: A.S. Kaye, P.T. Deniels (Eds.), Phonologies of Asia and Africa Inc. Caucasus. Winona Lake, Indiana, vol. I, 1997, pp. 205–217.
[24] J. Heath, Arabic derivational ablaut, processing strategies, and consonantal "roots", in: J. Shimron (Ed.), Language Processing and Acquisition in Languages of Semitic Root-based, Morphology, John Benjamins, Amsterdam, 2003, pp. 100–115.
[25] Y. Hilaal, Deriving from roots and word patterns, Linguist. Commun. 1 (1990) 77–80.
[26] R. Hindmarsh, Cambridge English Lexicon, Cambridge University Press, Cambridge, 1980.
[27] A. Kilgarriff, BNC Database and Word Frequency Lists, 2006 (accessed 09.10.11), http://www.kilgarriff.co.uk/bnc-readme.html#lemmatised.
[28] B. Kirkici, H. Clahsen, Inflection and derivation in native and non-native language processing: masked priming experiments on Turkish, Biling. Lang. Cognition 16 (4) (2013) 776–791.
[29] A. Laudanna, W. Badecker, A. Caramazza, Processing inflectional and derivational morphology, J. Mem. Lang. 31 (1992) 333–348.
[30] G. Lukatela, B. Gligorijevic, A. Kostic, Representation of inflected nouns in the internal lexicon, Mem. Cognition 8 (1980) 415–423.
[31] W.D. Marslen-Wilson, L.K. Tyler, Dissociating types of mental computation, Nat. Rev. Neurosci. 387 (1997) 592–594.
[32] A. Masrai, Investigating and Explaining the Relationship between L1 Mental Lexicon Size and Organisation and L2 Vocabulary Development, Unpublished PhD thesis, Swansea University, 2015.
[33] A. Masrai, J. Milton, An investigation of the relationship between L1 lexical translation equivalence and L2 vocabulary acquisition, Int. J. Engl. Linguist. 5 (2) (2015) 1–7.
[34] A. Masrai, J. Milton, Investigating the relationship between the morphological processing of regular and irregular words and L2 vocabulary acquisition, Int. J. Appl. Linguist. Engl. Lit. 4 (4) (2015) 192–199.
[35] P.H. Matthews, Morphology, Cambridge University Press, Cambridge, 1991.
[36] C. McBride-Chang, R.K. Wagner, A. Muse, B.W.-Y. Chow, H. Shu, The role of morphological awareness in children's English reading and vocabulary acquisition, Appl. Psycholinguist. 26 (2005) 415–435.
[37] J. McCarthy, A prosodic theory of nonconcatenative morphology, Linguist. Inq. 12 (1981) 373–418.
[38] J. McCarthy, Prosodic templates, morphemic templates, and morphemic tiers, in: H. Van der Hulst, N. Smith (Eds.), The Structure of Phonological Representations, Foris Publications, Dordrecht, 1982, pp. 191–223.
[39] J. McClelland, J. Elman, The TRACE model of speech perception, Cogn. Psychol. 18 (1) (1986) 1–86.
[40] P. Meara, J. Milton, X_Lex, the Swansea Levels Test, Express, Newbury, 2003.
[41] W.E. Nagy, R.C. Anderson, How many words are there in printed school English? Read. Res. Quart. 19 (3) (1984) 304–330.
[42] I.S.P. Nation, Vocabulary Lists: Words, Affixes and Stems, English University of Wellington, New Zealand, 1984 (English Language Institute).
[43] I.S.P. Nation, Learning Vocabulary in Another Language, Cambridge University Press, Cambridge, 2001.
[44] E. Nicoladis, What compound nouns mean to preschool children, Brain Lang. 84 (2003) 38–49.
[45] S. Pinker, Words and Rules: the Ingredients of Grammar, Basic Books, New York, 1999.
[46] R. Ratcliffe, Sonority-based parsing at the margins of Arabic morphology, Alcarabiyya 37 (2004) 73–95.
[47] D. Rumelhart, J. McClelland, On learning the past tense of English verbs: implicit rules or parallel distributed processing, in: J. McClelland, D. Rumelhart (Eds.), Parallel Distributed Processing: Explorations in the Microstructure of Cognition, MIT Press, MA, Cambridge, 1986, pp. 216–271.
[48] R.F. Stanners, J.J. Neisser, W.P. Hernon, R. Hall, Memory representation for morphologically related words, J. Verbal Learn. Verbal Behav. 18 (1979) 399–412.
[49] G.T. Stump, Inflectional Morphology, Cambridge University Press, Cambridge, 2001.
[50] M.T. Ullman, A Mental Model of Morphology: the Psychological and Neural Basis of the Computation of Complex Words, vol10, University of Maryland Working Papers in Linguistics, 2000, pp. 127–156.
[51] M.T. Ullman, Contributions of memory circuits to language: the declarative/procedural model, Cognition 92 (1–2) (2004) 231–270.
[52] M.T. Ullman, A cognitive neuroscience perspective on second language acquisition: the declarative procedural model, in: C. Sanz (Ed.), Mind and Context in Adult Second Language Acquisition: Methods, Theory and Practice, Georgetown University Press, Washington, DC, 2005, pp. 141–178.